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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/615,478	07/08/2003	Kwan Yong Lim	29936/39485	9262

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EXAMINER	
SARKAR, ASOK K	

ART UNIT	PAPER NUMBER
2829	

DATE MAILED: 11/17/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/615,478	LIM ET AL.	
	Examiner	Art Unit	
	Asok K. Sarkar	2829	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *18 October 2004*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-20* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *08 July 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

1. Applicant's arguments with respect to claims 1 – 20 have been considered but are moot in view of the new ground(s) of rejection.

Claim Objections

2. Claims 1, 19 and 20 are objected to because of the following informalities: The word "on" following the phrase "gate pattern' should be replaced by "in". Appropriate correction is required.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

4. Claims 1 – 3, 11, 12 and 15 are rejected under 35 U.S.C. 102(e) as being anticipated by Dobuzinsky, US 5,412,246.

Regarding claim 1, Dobuzinsky teaches a method of forming a gate in a semiconductor device, comprising the steps of:

- forming a gate pattern on which a gate oxide film 32 and a conductive layer 34 are stacked at a give region on a semiconductor substrate 30 with reference to Fig. 4A;

- forming a hard mask 36 on top of the gate pattern; and
- performing oxygen plasma treatment to form oxide film 38 at the sides of the conductive layer 34 and not on the hard mask 36 with reference to Fig. 4B in column 6, lines 30 – 55.

Regarding claims 2 and 3, Dobuzinsky teaches gate oxide film of silicon oxide in column 6, lines 55 – 60.

Regarding claim 11, Dobuzinsky teaches plasma treatment by applying the RF source power of 100 - 3000W and RF bias power of 0 – 100 W in column 6, lines 45 – 55.

Regarding claim 12, Dobuzinsky teaches plasma treatment by oxygen in column 6, lines 45 – 55.

Regarding claim 15, Dobuzinsky teaches plasma treatment at substrate temperature of 0 – 450 °C in column 6, lines 45 – 55.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.

2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

7. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

8. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Dobuzinsky, US 5,412,246 in view of Lin, US 6,746,925.

Dobuzinsky fails to teach high dielectric metal oxide films.

Lin teaches gate dielectric metal oxide films of HfO_2 for the benefit of retaining the electrical characteristics of thin gate dielectric layer in column 3, lines 15 – 67.

Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention to modify Dobuzinsky and form gate oxide film with high dielectric metal oxide film such as HfO_2 for the benefit of retaining the electrical characteristics of thin gate dielectric layer as taught by Lin in column 3, lines 15 – 67.

9. Claims 5 – 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dobuzinsky, US 5,412,246 in view of Mandelman, US 6,720,630.

Regarding these claims, Dobuzinsky fails to teach detailed structure of the gate stack comprising, a polysilicon film, an anti-diffusion film, a metal film and a hard mask (claims 5 – 10).

Mandelman teaches forming a gate stack comprising, a polysilicon film, an anti-diffusion film of TaSiN or WN, a metal film of W and a hard mask of nitride for the benefit of providing a diffusion free low resistivity gate structure for MOSFET devices with reference to Fig. 2 and in column 4, lines 13 – 62.

Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention to modify Dobuzinsky and form the gate stack comprising, a polysilicon film, an anti-diffusion film of TaSiN or WN, a metal film of W and a hard mask of nitride for the benefit of providing a diffusion free low resistivity gate structure for MOSFET devices as taught by Mandelman in column 4, lines 13 – 62.

10. Claims 13 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dobuzinsky, US 5,412,246 as applied to claims 1 and 11 above, and further in view of Kashiwagi, US 6,297,172.

Dobuzinsky fails to teach plasma treatment performed using oxygen and hydrogen in a flow ratio of 0.01 ~ 0.2.

Kashiwagi teaches plasma oxidation using oxygen and hydrogen in column 9, lines 65 – 67 for the benefit of providing very thin oxide film with excellent reliability in column 18, lines 50 – 51.

Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention to modify Dobuzinsky and form the oxide film by plasma oxidation

using oxygen and hydrogen for the benefit of providing very thin oxide film with excellent reliability as taught by Kashiwagi in column 18, lines 50 – 51

11. Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Dobuzinsky, US 5,412,246 as applied to claims 1 above, and further in view of Kizilialli, US 6,320,238.

Dobuzinsky fails to teach implementing the oxygen plasma treatment by illuminating ultraviolet rays on the top of the substrate.

Kizilialli teaches illuminating ultraviolet rays to activate the ozone, which can used for the plasma oxidation process as well-known process in column 4, lines 41 – 50.

Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention to modify Dobuzinsky and implement the oxygen plasma treatment by illuminating ultraviolet rays on the top of the substrate by supplying ozone as an oxidizing gas taught by Kizilialli as well-known in the art in column 4, lines 41 – 50.

12. Claims 17 and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dobuzinsky, US 5,412,246 as applied to claims 1 above, and further in view of Kizilialli, US 6,320,238 and Misra, US 6,274,429.

Dobuzinsky fails to teach annealing process for the plasma formed oxide film.

Kizilialli teaches annealing of the oxide film in nitrogen atmosphere at a temperature of 600 ~ 1000°C for the benefit of providing a stress free film in column 4, lines 61 – 65.

Misra teaches oxide annealing for a time of 10 sec ~ 60 min for the benefit of providing good electrical quality to oxide film in column 4, lines 15 – 39.

Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention to modify Dobuzinsky and perform an annealing process for plasma deposited oxide film in nitrogen atmosphere at a temperature of 600 ~ 1000°C for a time of 10 sec ~ 60 min for the benefit of providing a stress free film as taught by Kizilalli in column 4, lines 61 – 65 and for the benefit of providing good electrical quality to oxide film as taught by Misra in column 4, lines 15 – 39.

13. Claims 19 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dobuzinsky, US 5,412,246 in view of Mandelman, US 6,720,630; Kizilialli, US 6,320,238 and Misra, US 6,274,429.

Limitations of these claims have been described earlier in rejecting claims 1 – 10, 17 and 18.

Conclusion

14. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the

shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

15. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Asok K. Sarkar whose telephone number is 571 272 1970. The examiner can normally be reached on Monday - Friday (8 AM- 5 PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Tokar can be reached on 571 272 1812. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

16. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Asok Kumar Sarkar
Asok K. Sarkar
November 15, 2004

Patent Examiner